

SYSTEMS AND TECHNIQUES FOR MUTING MANAGEMENT IN MULTI-CELL COORDINATION

TECHNICAL FIELD

[0001] The present invention relates generally to wireless network communication. More particularly, the invention relates to improved systems and techniques for multi-cell coordinated scheduling.

BACKGROUND

[0002] Efficiency in wireless network communication is an important objective, becoming more and more important as the number of users and their demands for service continue to increase. Network operators wish to minimize the infrastructure they must provide. In addition, the frequency bands dedicated to wireless network communication are a finite and valuable resource, and network operators are constantly working to use this resource efficiently in order to prevent the available frequencies from becoming oversaturated. If frequencies are oversaturated, network elements will interfere with one another. For example, transmission by one base station may interfere with transmission by an adjacent base station. In order to prevent interference, network operators may take into account the presence of nearby transmitters in making scheduling decisions, and transmitters (such as base stations) may coordinate their transmissions so as to avoid interference with one another.

SUMMARY

[0003] In one embodiment of the invention, an apparatus comprises at least one processor and memory storing a program of instructions. The memory storing the program of instructions is configured to, with the at least one processor, cause the apparatus to at least, in response to a control assertion request to allow a controlling entity to control coordinated radio transmission by the apparatus, respond with an acceptance or denial of the request and, if the response is an acceptance, perform coordinated transmission under control of the controlling entity.

[0004] In another embodiment of the invention, a method comprises, in response to a control assertion request to allow a controlling entity to control coordinated radio transmission by a base station, responding with an acceptance or denial of the request and, if the response is an acceptance, performing coordinated transmission under control of the controlling entity.

[0005] In another embodiment of the invention, a non-transitory computer readable medium stores a program of instructions. Execution of the program of instructions by at least one processor configures an apparatus to at least in response to a control assertion request to allow a controlling entity to control coordinated radio transmission by the apparatus, respond with an acceptance or denial of the request and, if the response is an acceptance, perform coordinated transmission under control of the controlling entity.

[0006] In another embodiment of the invention, an apparatus comprises at least one processor and memory storing a program of instructions. The memory storing the program of instructions is configured to, with the at least one processor, cause the apparatus to at least send a control assertion request to a base station, requesting control of coordinated radio transmission by the base station and, in response to accep-

tance of the request by the base station, send one or more requests to the base station to mute transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 illustrates a wireless network according to an embodiment of the present invention;

[0008] FIGS. 2-6 illustrate signaling between and operations of elements carrying out embodiments of the present invention;

[0009] FIG. 7 illustrates details of elements according to an embodiment of the present invention; and

[0010] FIG. 8 illustrates a process according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0011] Embodiments of the present invention address improvements to coordinated multipoint communication—specifically, multi-cell coordinated scheduling. Various approaches to multi-cell coordinated scheduling are in development or in use in cellular communication systems. These include centralized and decentralized approaches. Base stations may coordinate transmission order to avoid interference with one another. One mechanism is to mute transmission requiring particular resources or at a particular time (with muting being defined as a zero-power transmission or interval), while another mechanism is to transmit at reduced power in particular resources or time periods. In a decentralized approach to coordinated scheduling, a cell, which may be represented by a base station, makes its own decision on muting (that is, refraining from transmitting or scheduling transmission from one or more of its user devices). In networks operating according to standards of the third generation partnership project (3GPP), 3GPP long term evolution (LTE) and 3GPP LTE-advanced (LTE-A), a base station may be implemented as an eNodeB (eNB), with an eNB serving user equipments (UEs) within its coverage area.

[0012] In a network or portion of a network that follows a centralized approach, a central entity makes decisions about whether a particular base station should mute, and issues an appropriate request to the base station (such as an eNB). A base station may be designed for centralized control (such a base station may be referred to for convenience as a centrally controlled base station) or may be designed for decentralized operation (such a base station may be referred to as an autonomous base station—meaning that the base station's coordination decisions are autonomous). A centrally controlled base stations will perform coordination as directed by the central entity, and an autonomous base station will generally ignore requests by the central entity. In some cases, a base station may respond to requests from a central entity during most of its operation, but, under some circumstances, ignore requests and make its own decisions. Such circumstances may include, for example, handling of high priority traffic using specified resources. Such a base station may be referred to for convenience as a partially autonomous base station. The various elements participating in and controlling coordinated transmission may be referred to as nodes, and one or more of the nodes may conveniently be referred to as an independent node, which may control and direct other nodes, but which may not itself serve a user device. In one or more embodiments of the invention, the central entity may be an independent node.